Surveys for the Eltham copper butterfly *Paralucia pyrodiscus lucida* Crosby (Lycaenidae) in Victoria in late 2011

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Abstract
Recent surveys for the Eltham copper butterfly *Paralucia pyrodiscus lucida* Crosby have revealed several previously unknown populations in the Wimmera (1), near Castlemaine (4) and near Bendigo (1). Their significance is discussed in relation to the butterfly's conservation and management, including design of fuel reduction burning for occupied sites (*The Victorian Naturalist* **129** (3), 2012, 114–118)

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Introduction

The Eltham copper butterfly *Paralucia pyrodiscus lucida* Crosby (ECB), is of significant conservation interest, and is amongst the best documented threatened insect taxa in Victoria, where it has become a notable flagship for invertebrate conservation (Canzano *et al.* 2007, New 2010). The few known populations, each small and isolated, are concentrated in three main regions, namely outer north-eastern suburbs of Melbourne (Eltham, Greensborough), the central wooded countryside spanning Castlemaine and Bendigo (with recent discoveries in the latter area reported by Canzano and Whitfield 2008), and a smaller representation near Kiata in the Wimmera area. The butterfly is invariably associated with its sole larval food plant *Bursaria spinosa* Cav. and caterpillars also have a mutualistic association with ants, *Notoncus* spp. *Bursaria spinosa* and identified host species of *Notoncus* are widespread, and occur in many places in Victoria where *Paralucia* is absent, some of these appearing entirely suitable for habitation.

The ECB is one of very few Victorian invertebrates for which site management by control burning has been attempted in the past (New *et al.* 2000) and for which tentative fire prescriptions can be based on practical experience and knowledge of the species' biology, albeit at sites near Melbourne rather than the areas explored here. With such background knowledge, it was a prime candidate for investigation in order to further characterise its distribution and seek additional populations that might be vulnerable to fuel reduction burns anticipated for asset protection in areas where it might occur (New *et al.* 2012). Some occupied sites are close to residential developments, where regulating fires may be both a high priority and a very complex exercise to undertake sensitively. Negotiations on optimal fire regimes to protect ECB, if those regimes can be defined, are also likely to be complex. Any strictures on burning operations close to human settlements may need very careful consideration to achieve asset protection without further threatening any species listed under the *Flora and Fauna Guarantee Act* 1988.

In this note, we report the outcomes of targeted surveys for the butterfly undertaken in late 2011, based on searches for adult butterflies.

Methods

During the main adult flight season of *P.p. lucida* in late 2011 (November, December), systematic surveys of the regional non-Melbourne populations were undertaken by trained observers familiar with the butterfly and unlikely to confuse it with any other taxon. Surveys included known occupied and historically occupied sites, and additional areas of potentially suitable habitat within the wider regions. During the time available, we have attempted to

undertake sufficient additional field investigation to explore the presence and size of populations of the Eltham copper in all known extra-Melbourne localities, and to search for further populations within the potential range, guided by presence of *Bursaria*, and recording such potential habitat. Although *Notoncus* is also a critical resource for ECB, it was not sought directly on the sites visited. Each site visited was characterised, its position mapped for future reference and possible re-survey, and presence/absence of adult *P. p. lucida* noted.

Altogether, 15 sites in the Wimmera were explored (by FD). Extensive searches (coordinated by JW) were undertaken over public land within the large potentially habitable region around Castlemaine and Bendigo. Over a six-week period, the potential habitat areas were traversed at about 60 m intervals in search of *B. spinosa*, as a basis for categorising habitat suitability and a focus for future searches. Around Castlemaine, 1565 ha of potential habitat included 63 core habitat sites and a further 54 smaller patches of *Bursaria*. Near Bendigo, 980 ha included 23 core habitat sites and 26 smaller patches. These categories were separated by amount of *Bursaria* — 'core habitat' units were areas with >200 plants present, with the smaller patches considered valuable in promoting connectivity but less likely to sustain butterfly populations. Limited time for the surveys precluded revisiting many potentially habitable sites indicated by presence of *Bursaria*, and these are priority for inspection to determine status of ECB in the 2012-2013 flight season. Despite the work reported here, much further exploration is needed within this region.

Results

Detailed information on all sites surveyed is available in a report submitted to the Department of Sustainability and Environment (Yen and New 2012). The following is a brief summary of findings in the two regions surveyed.

Wimmera

Paralucia pyrodiscus lucida was confirmed present at five sites within the Kiata Flora Reserve, which is thus endorsed as harbouring major concentration of populations within the region and of substantial conservation importance. However, it was not found at the nearby Salisbury Bushland Reserve, from where historical records exist; as no specimens have been seen at Salisbury during a number of targeted searches over the last decade, it may now be extinct there. The main patch of *Bursaria* at Salisbury is fenced to exclude grazers, but current weed invasion is an additional threat.

A previously unknown and seemingly strong population of ECB was discovered along the sides of Nursery Road abutting a Sugar Gum plantation on the north-east boundary of Wail State Forest, at 54HO595925 UTM 5960515 (36° 29' 47.00"S, 142° 04'17.12"E, south-east) to 54H0595640 UTM5960861 (36° 29' 37.87" S, 142° 04' 07.14"E, north-west). The roadsides support a strong *Bursaria* population and are in good natural condition. Eight newly surveyed sites, each with strong *Bursaria* patches that did not yield ECB, included those at and around Winiam, Dimboola, Nhill, Antwerp and West Wail.

Castlemaine/Bendigo (Fig. 1)

All previously recorded sites still support ECB. The great majority of additional sites inspected did not yield ECB, and a number of 'core' sites have been noted for additional survey in the future. Some are on areas that have been disturbed in the past, such as along roadsides and channels. Previously unknown populations, most recorded from individual sightings (with low numbers possibly reflecting surveys outside the peak flight period, as for absences from other sites), were found in each region. Four were around Castlemaine, one near Bendigo. They are: (1) a north-facing slope south of the Castlemaine-Muckleford Road, and within a recently-conducted fuel reduction burn area (55HO250766, UTM 5896499; 37° 2' 34.9"S, 144° 1' 55.9"E); (2) east of Youngman's Track, and in a recently burned area, as above (55HO251826, UTM 5897640; 37° 1' 59"S, 144° 12' 40.1"E); (3) a roadside site to the south of Castlemaine, on Dingo Park Road (55HO255015, UTM 5892398; 37° 4' 51.9" S, 144° 14' 42.9"E); (4) Broad Road, Campbells Creek (55H0253059, UTM 5891538; 37° 5' 23.8" S, 144° 13' 17.9" E); and (5) a site to the south of Bendigo between Kangaroo Flat and Strathdale, with suitable habitat extending over 30 ha (55HO257100, UTM 5924217; 36°47'

42. 4"S, 144° 16' 44"E). The last is regarded as a priority site, on which large areas of *Bursaria* should be excluded from burns.

Discussion

In both regions surveyed, *Bursaria* is very patchy in the landscape, and numbers of the plant very variable. Many small patches are perhaps unlikely to support viable ECB populations, and apparently suitable habitat patches are sparse within the wider landscape. However, because ECB can thrive on sites of less than 2 ha, as around Eltham, isolation may be more relevant than size in explaining absence. Around Castlemaine/Bendigo, the large and continuous populations of *Bursaria*, as at Kalimna Park (Castlemaine), appear to support the most significant populations of ECB.

The discovery of several new populations of *P. p. lucida* is a very positive outcome from this work. These populations all appear to be very restricted in extent, and isolated, but confirm the importance of concentrated surveys in detecting such elusive and patchily-distributed taxa. Despite the importance of large sites, the small site areas in Eltham that have supported populations for at least several decades demonstrate also the importance of very small areas for conservation. We suggest that rather than leading to a perception that the butterfly is more widely distributed than previously known, the new discoveries urge a need for even greater site protection; this would enable connectivity and

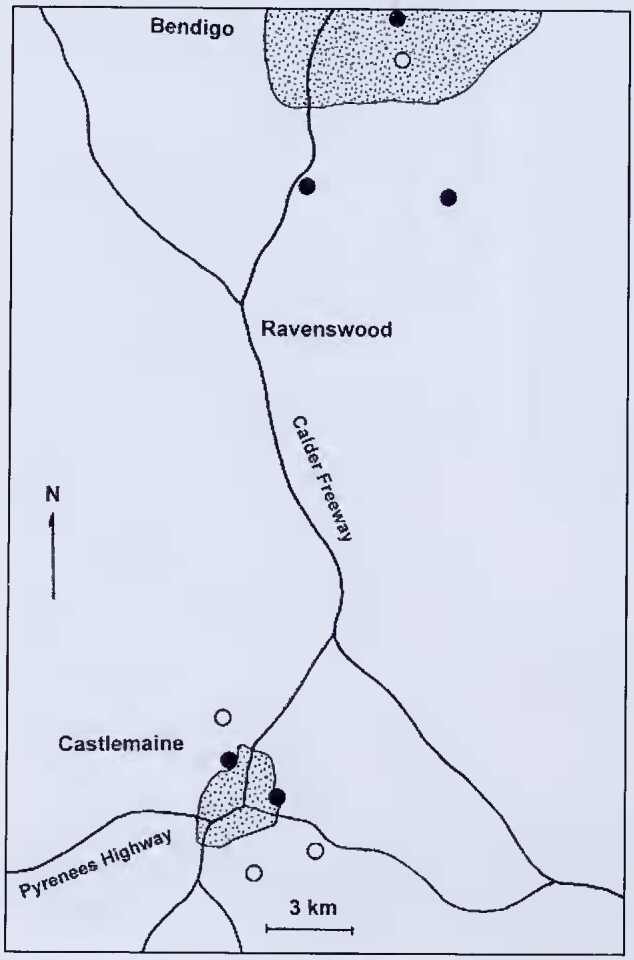

Fig. 1. Indicative relative positions of populations of *Paralucia pyrodiscus lucida* within the Castlemaine/greater Bendigo region: populations discovered during this survey (open circles) are shown together with previously known populations (solid circles).

protect all known populations and sites of all sizes until their real status is clarified. Whilst the newly discovered presence of ECB on recently burned sites is an encouraging sign of its resistance to that treatment, numbers seen were very low and the regimes and impacts of the burns unclear. Any future burns on these sites should heed the distribution of the butterfly there, and be undertaken sympathetically in assuring its conservation. The optimal burning regimes for ECB conservation have not been investigated beyond Eltham, so that such a precautionary approach seems imperative. From experiences in burning two sites at Eltham, where the butterfly's phenology is somewhat different from that at the sites discussed here, burns were considered to be 'safest' if undertaken in early autumn (when caterpillars were the only stage present, were part-developed prior to winter, and able to take refuge in *Notoncus* nests), and when 'hotspots' of known abundance could be protected by damping down. However, for any site to be burned, there is likely to be conflict between community concerns and optimal timing adjudged from biological information. The small occupied areas also endorse the need for (and wisdom of) small scale mosaic management, be it by fire or other means, to sustain suitability. Ideally, these should follow surveys to detect any 'hotspots' of ECB to be shielded from loss and, so, augment conservation benefit from burns undertaken primarily for fuel reduction and asset protection.

The former population at Salisbury was not rediscovered and it is likely that this is now extinct.

The major new discoveries are:

1. a population in the Wail State Forest, as an important intermediate locality between Kiata and Castlemaine and, perhaps constituting a further 'fragment' indicating that the historical range of the butterfly was more extensive than at present;
2. a further population in the southern area of Bendigo. We note that this site is within the area of an Asset Protection burn scheduled for autumn 2012, and that much of the area explored in the region, as around Castlemaine, is within the Asset Protection Zone susceptible to fuel reduction burning over the next few years;
3. further populations near Castlemaine, adding to those in the Castlemaine Botanic Gardens and Kalimna Park. Two are within a Zone 1 Asset Protection Zone, as is the Bendigo site, and so have potential to be burnt every 5-8 years and to have 90% of the areas treated to reduce fuel hazard to moderate levels.

The increased documentation of *P. p. lucida* supports the commonly held view that populations are largely discrete (closed and demographically independent) and very limited in area. However, proximity of some of these (for example, at Castlemaine) leaves open the possibility of a metapopulation structure, so that landscape level conservation management in the regions of occurrence is clearly needed to oppose further fragmentation, as well as promote individual management for sustainability of all inhabited sites.

The other major outcome is endorsement that the butterfly is indeed absent from much apparently suitable habitat, including patches close to confirmed populations. These absences based on systematic targeted searches suggest (notwithstanding the 'single visit' limitation noted earlier, and lack of searches for *Notoncus* ants) the reality of the butterfly's patchiness and highly localised distribution and that it is truly of conservation concern, rather than the documented distribution simply reflecting under-recording. Within any site, butterflies are also restricted: the newly discovered Wail site, for example, supports a population occupying only about 400 x 30 m on a roadside verge. Such sites merit special notice as vulnerable to road maintenance works and similar disturbance, and should be signalled to the responsible authority for protection. However, the apparent suitability to *P. p. lucida* of many vacant sites suggests that the major critical resources for the butterfly are not in themselves sufficient indicators of likelihood of its occurrence: predictive modeling for the butterfly's incidence cannot yet be formulated soundly, with preliminary trials based on both incomplete information and inadequate understanding. Prudence dictates that no population is expendable and that all occupied sites should be conserved. Current population sizes on the newly discovered sites are unknown, as is the extent of functional isolation of butterfly populations on each. At

Kiata and at Kalimna Park, Castlemaine, it is known that ECB is quite mobile and can track patches of *Bursaria* across distances of up to several hundred metres (Canzano *et al.* 2007, New 2010). Large sites adjacent to known populations may thus be particularly important to conserve.

A more general lesson is that any contemporary allocation of formal conservation status to a poorly-known invertebrate taxon must be open to review as new information accrues, and can only rarely be founded on definitive information. It is unusual, unfortunately, to have support of the level of this investigation for large-scale exploration for threatened invertebrates across much of the known or likely habitat area. However, despite this substantial effort for ECB, much habitat remains to be explored, and repeated surveys on occupied sites are needed to confirm the butterfly's status and abundance. The restricted period of apparency of adults, as the stage most amenable to rapid inspection, also limits such opportunity. Whilst the numerous non-inhabited 'core habitat quality' sites indicate priority search areas for the future (and for which substantial funding would be needed to furnish a more definitive picture of ECB incidence), their wellbeing within a mosaic of largely unsuitable habitat may be important for the future of the butterfly either as resources amenable to natural colonisation or as sites for deliberate translocation should currently occupied sites become unsuitable through degradation or human impacts.

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References

Canzano AA and Whitfield J (2008) Discovery of a further population of the Eltham copper butterfly *Paralucia pyrodiscus lucida* Crosby (Lepidoptera: Lycaenidae) in Bendigo, Victoria. *The Victorian Naturalist* **125**, 178–180.

Canzano AA, New TR and Yen AL (2007) The Eltham copper butterfly *Paralucia pyrodiscus lucida* Crosby (Lepidoptera: Lycaenidae): local versus state conservation strategy in Victoria. *The Victorian Naturalist* **124**, 236–242.

New TR (2010) *Butterfly Conservation in South-East Australia: progress and prospects*. (Springer: Dordrecht)

New TR, Van Praagh BD and Yen AL (2000) Fire and the management of habitat quality in an Australian lycaenid butterfly, *Paralucia pyrodiscus lucida*, the Eltham copper. *Metamorphosis* **11**, 154–163.

New TR, Van Praagh BD and Yen AL (2012) Invertebrate conservation status and the limits of reliable information: examples from Victoria, Australia. *The Victorian Naturalist* **129**, 68–76.

Yen AL and New TR (2012) VBRC Terrestrial Invertebrates: surveys for selected taxa, 2011. Unpublished report to Department of Sustainability and Environment, Victoria.

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Cicada. Photo by Dan Carey.